



Armed Forces College of Medicine AFCM



Long ascending pathways

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INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture, the student will be able to:

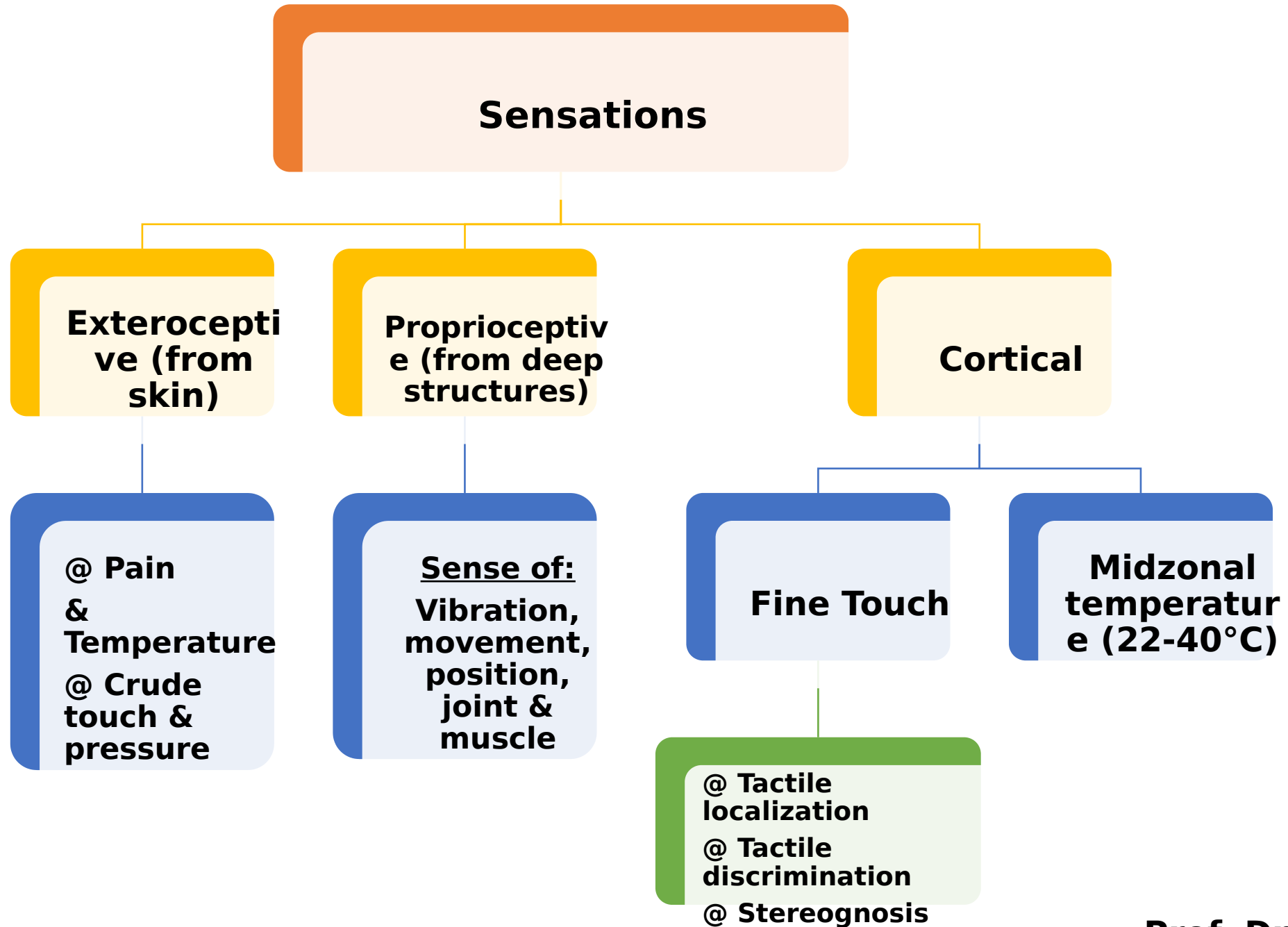
- 1. Define the four long ascending tracts carrying the different sensations.**
- 2. Describe the three order chain of each of which.**
- 3. Predict the effects of lesion of these**

Lecture Plan



- 1. Part 1 (10 min) Introduction to sensations & sensory pathways**
- 2. Part 2 (30 min) Spinothalamic tracts**
- 3. Part 3 (15 min) Dorsal column tracts**
- 4. Summary (5 min)**

Sensations



Sensory pathways

4 Long ascending tracts (reaching the cerebral cortex)

- **Ant. spino-thalamic tract** (for crude touch & pressure)
- **Lat. spino-thalamic tract** (for pain & temperature)
- **Gracile tract** (for light touch & proprioception from lower ½ of trunk & LL)
- **Cuneate tract** (for light touch & proprioception from upper ½ of trunk & UL)

4 Short ascending tracts (not reaching the cerebral cortex)

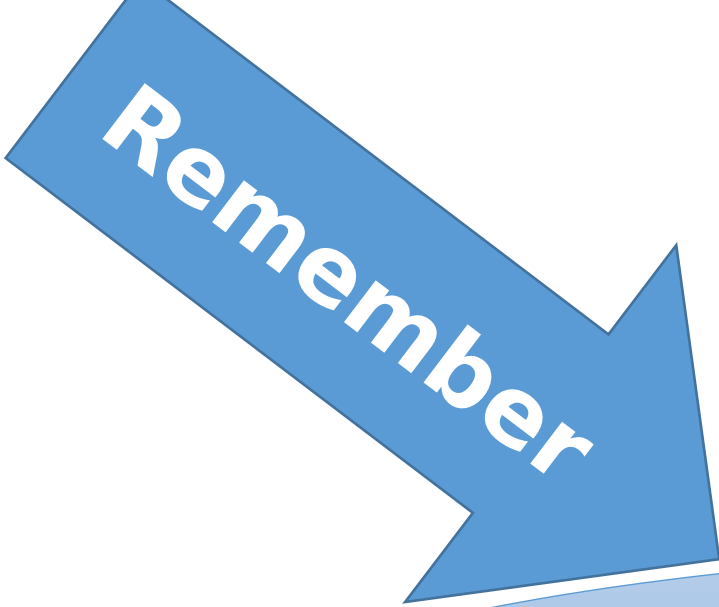
- **Spino-cerebellar tract**
- **Spino-tectal tract**
- **Spino-reticular tract**
- **Spino-olivary tract**

I. 4 Long ascending tracts (reaching the cerebral cortex)

- **Ant. spino-thalamic tract** (for crude touch & pressure)
- **Lat. spino-thalamic tract** (for pain & temperature)
- **Gracile tract** (for light touch & proprioception from lower $\frac{1}{2}$ of trunk & LL)
- **Cuneate tract** (for light touch & proprioception from upper $\frac{1}{2}$ of trunk & UL)

Solid Facts “till now”

- **Cerebellum** controls the **same (ipsilateral)** side of the body.
- **Cerebral cortex** controls the **opposite (contralateral)** side of the body.
- **Each cerebral cortex** has its own secretary (**THALAMUS**) on its **same** side.



In Sensory pathways,
sensations are carried from
receptors to cerebral cortex by
3 neurons:

The three - neurons chain

2nd neuron Crosses to
opposite side

1st order neuron □ DRG

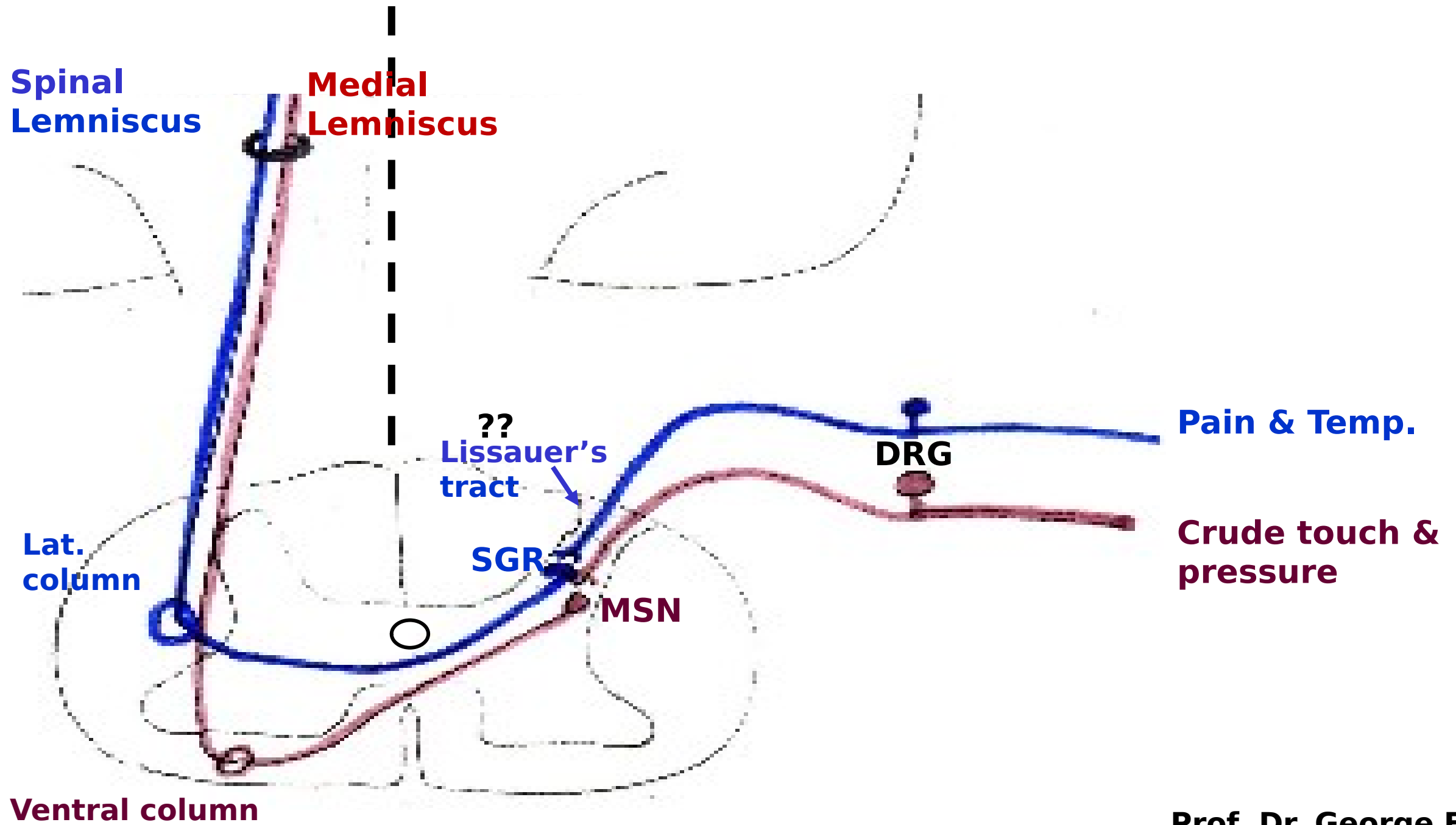
2nd order neuron □ spinal cord

or MO on same

side

3rd order neuron □ Thalamus

on the opposite side



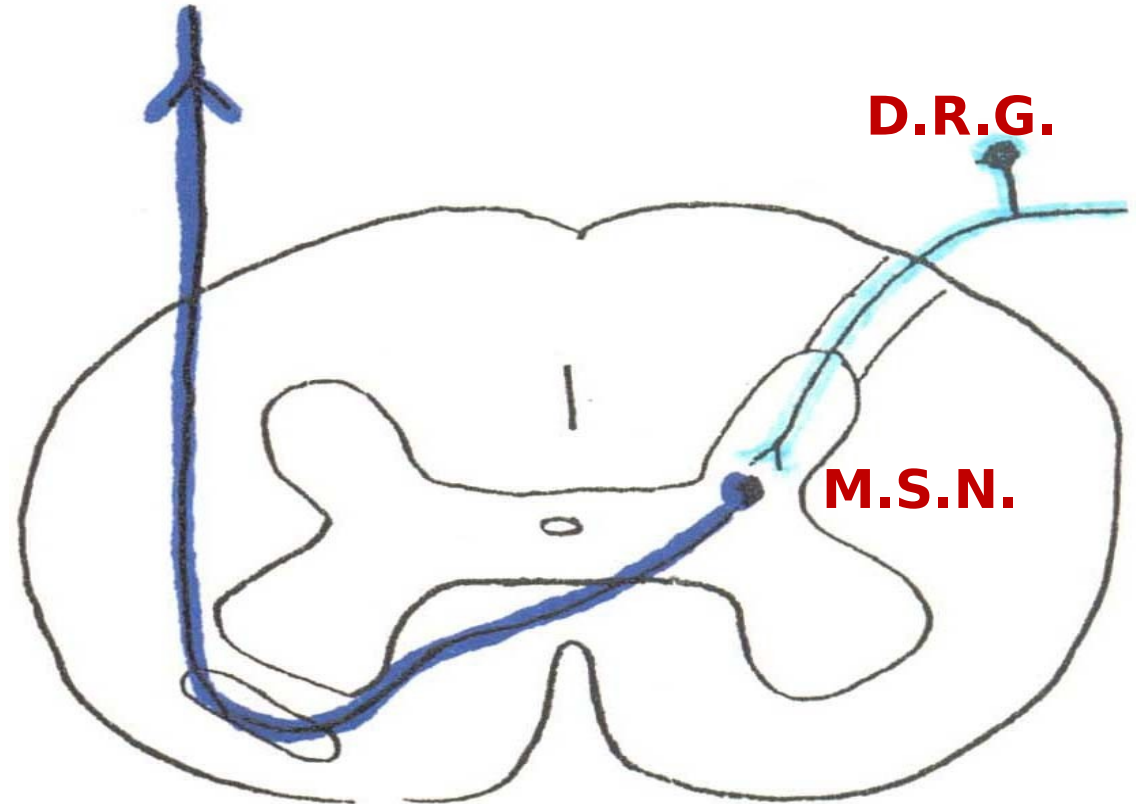
Ant. Spinothalamic Tract

Crude touch & Pressure Pathway = Ant. spino-thalamic tract

- **1ST ORDER NEURON:**

- Dorsal Root Ganglion (D.R.G.):**

- 1- Cells: are pseudo-unipolar
- 2- Peripheral processes:
Carry crude touch & pressure from the receptors.
- 3- Central processes:
Enter the spinal cord to terminate in **M.S.N.** of the corresponding segment.



Crude touch & Pressure Pathway = Ant. spino-thalamic tract

• 2ND ORDER NEURON:

M.S.N._

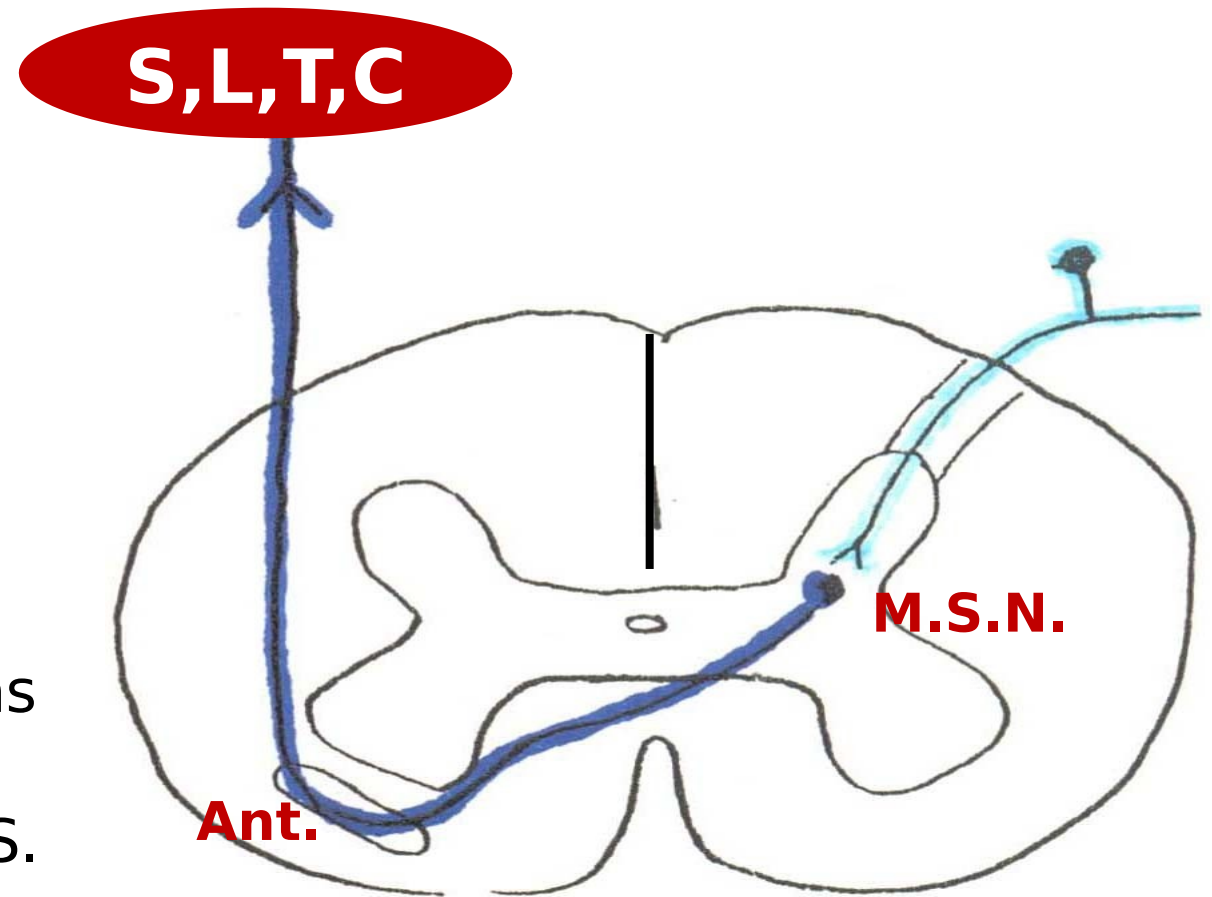
1- Cells: Cells of **M.S.N.**

2- Axons:

- Cross to the opposite side.
- Ascend in the **ANT.** column as the **ANT.** spino-thalamic tract.
- Ascend in the brain stem close to **LAT.** spino-thalamic tract & later joins the **MEDIAL Lemniscus**)

d. Lamination: C. fibers are med. & S. fibers are lat.

e. Terminate in: (P.L.V.N.T.) **P**ostero-
Lateral **V**entral **N**ucleus of **T**halamus.

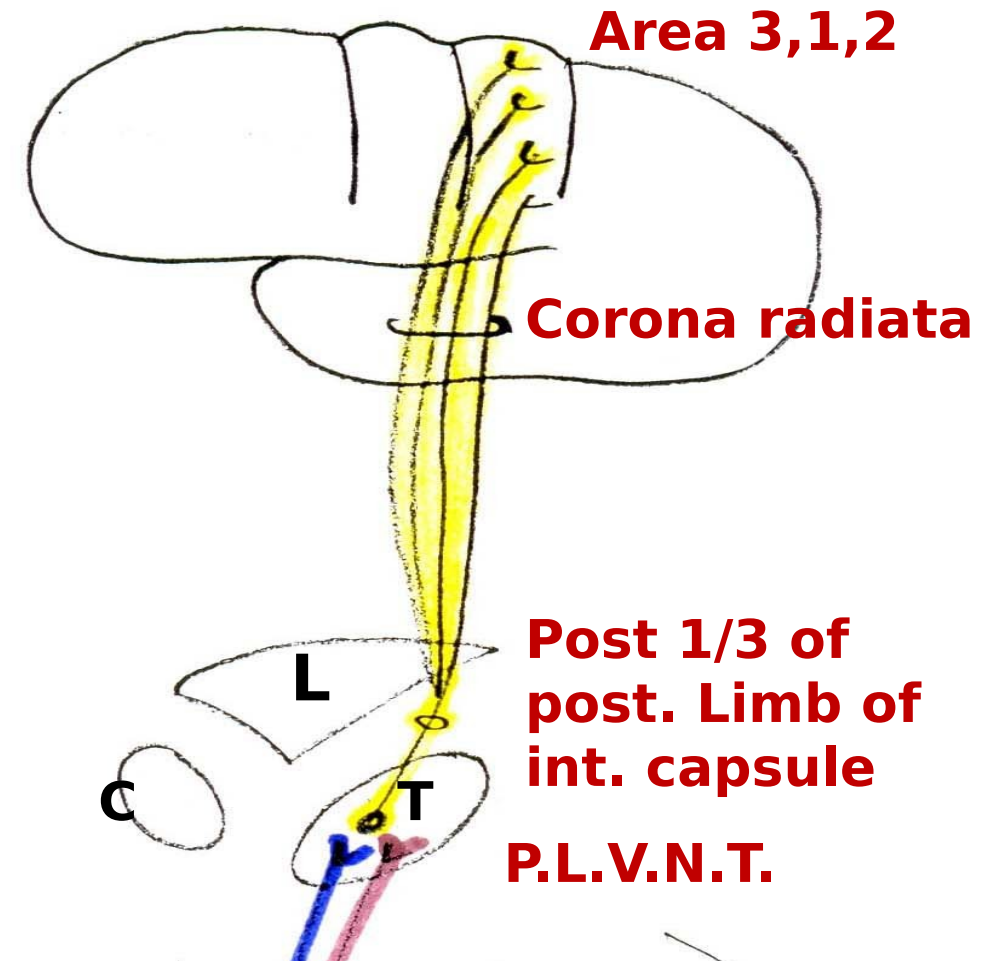


Crude touch & Pressure Pathway = Ant. spino-thalamic tract

- **3RD ORDER NEURON:**

P.L.V.N.T.:

- 1- Cells: Cells of P.L.V.N.T.
- 2- Axons:
 - a. Pass in sensory radiation in the post. 1/3 of post. limb of **internal capsule**.
 - b. Diverge in the **corona radiata**.
 - c. Terminate in **area 3,1,2 (sensory area) in the post-central gyrus** where the body is represented upside-down.



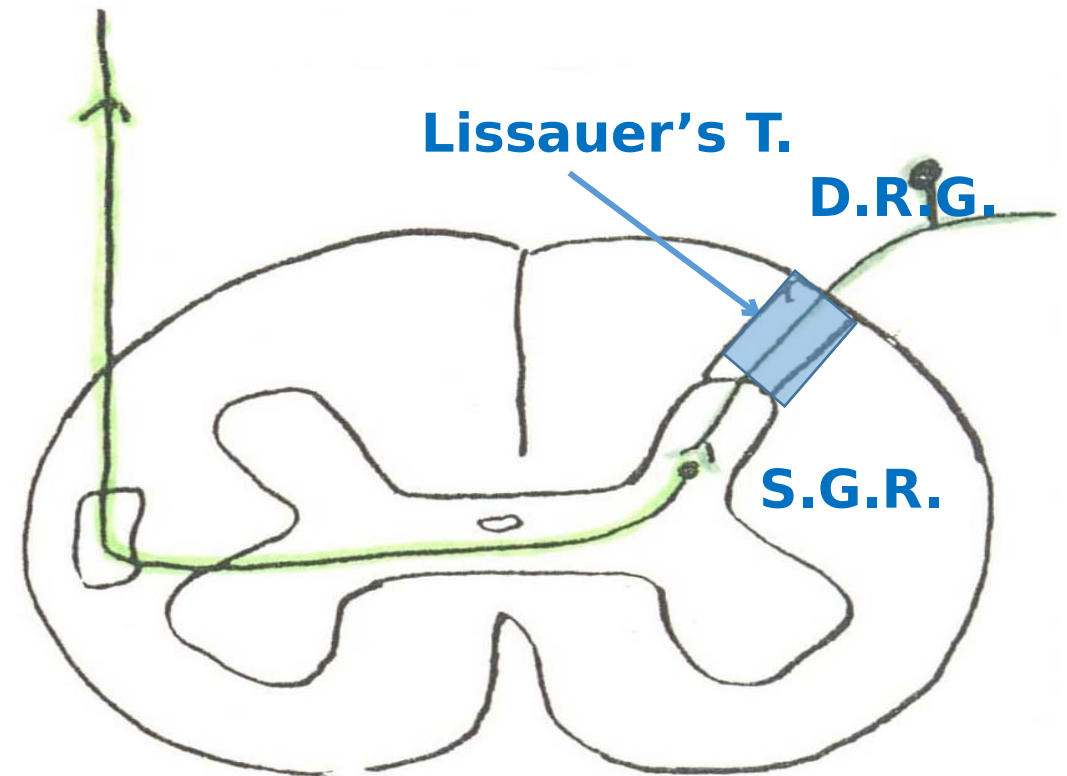
Lat. Spinothalamic Tract

Pain & Temperature Pathway = Lat. spino-thalamic tract

- **1ST ORDER NEURON:**

- Dorsal Root Ganglion (D.R.G.):**

- 1- Cells: are pseudo-unipolar
- 2- Peripheral processes:
Carry pain & temp. from the receptors.
- 3- Central processes:
 - a. Enter the spinal cord
 - b. Form the **Lissauer's tract**
(ascend & descend for 1 segment before terminating in)
 - c. **S.G.R.** of the corresponding



Pain & Temperature Pathway = Lat. spino-thalamic tract

• **2ND ORDER NEURON:** **S.G.R. :** **S,L,T,C**

1- Cells: Cells of **S.G.R.**

2- Axons:

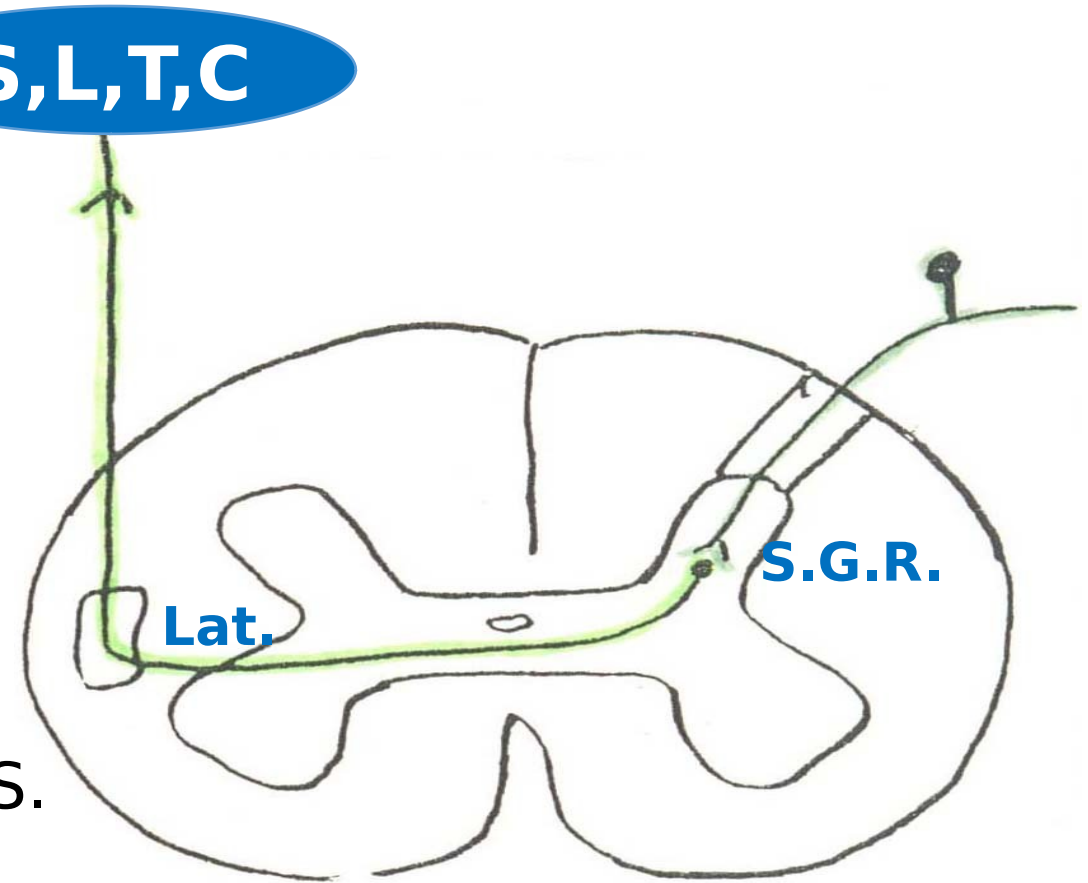
a. Cross to the opposite side.

b. Ascend in the **LAT.** column as the **LAT.** spino-thalamic tract.

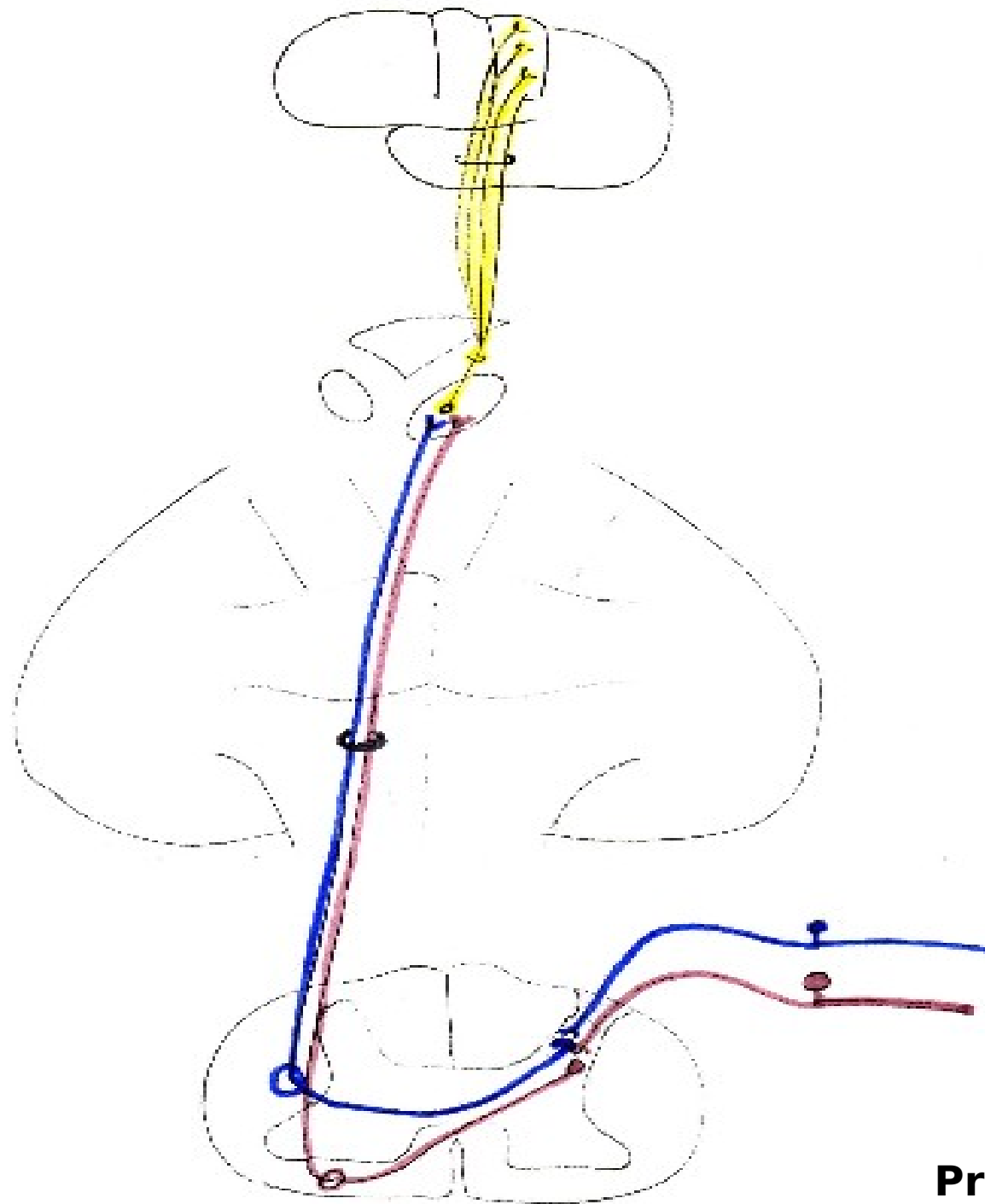
c. Ascend in the brain stem as the **Spinal Lemniscus**)

d. Lamination: C. fibers are med. & S. fibers are lat.

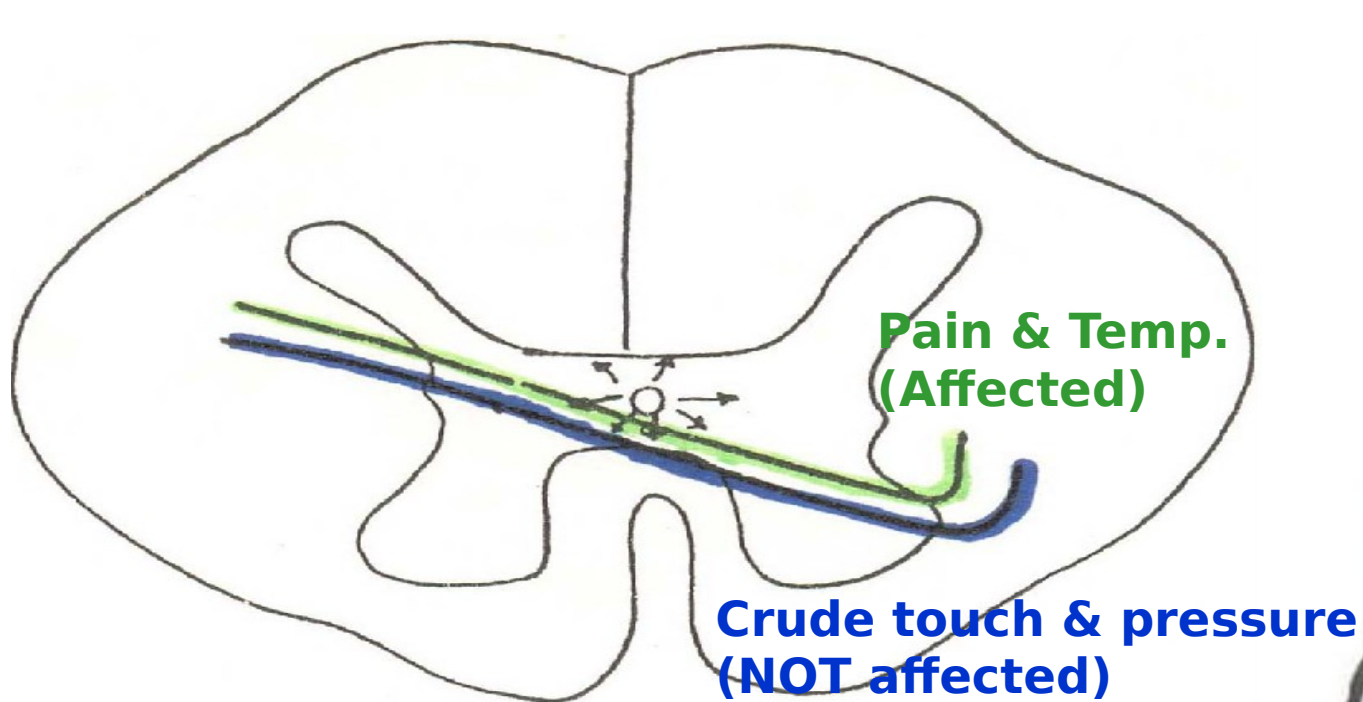
e. Terminate in: (P.L.V.N.T.) **P**ostero-
Lateral **V**entral **N**ucleus of **T**halamus.



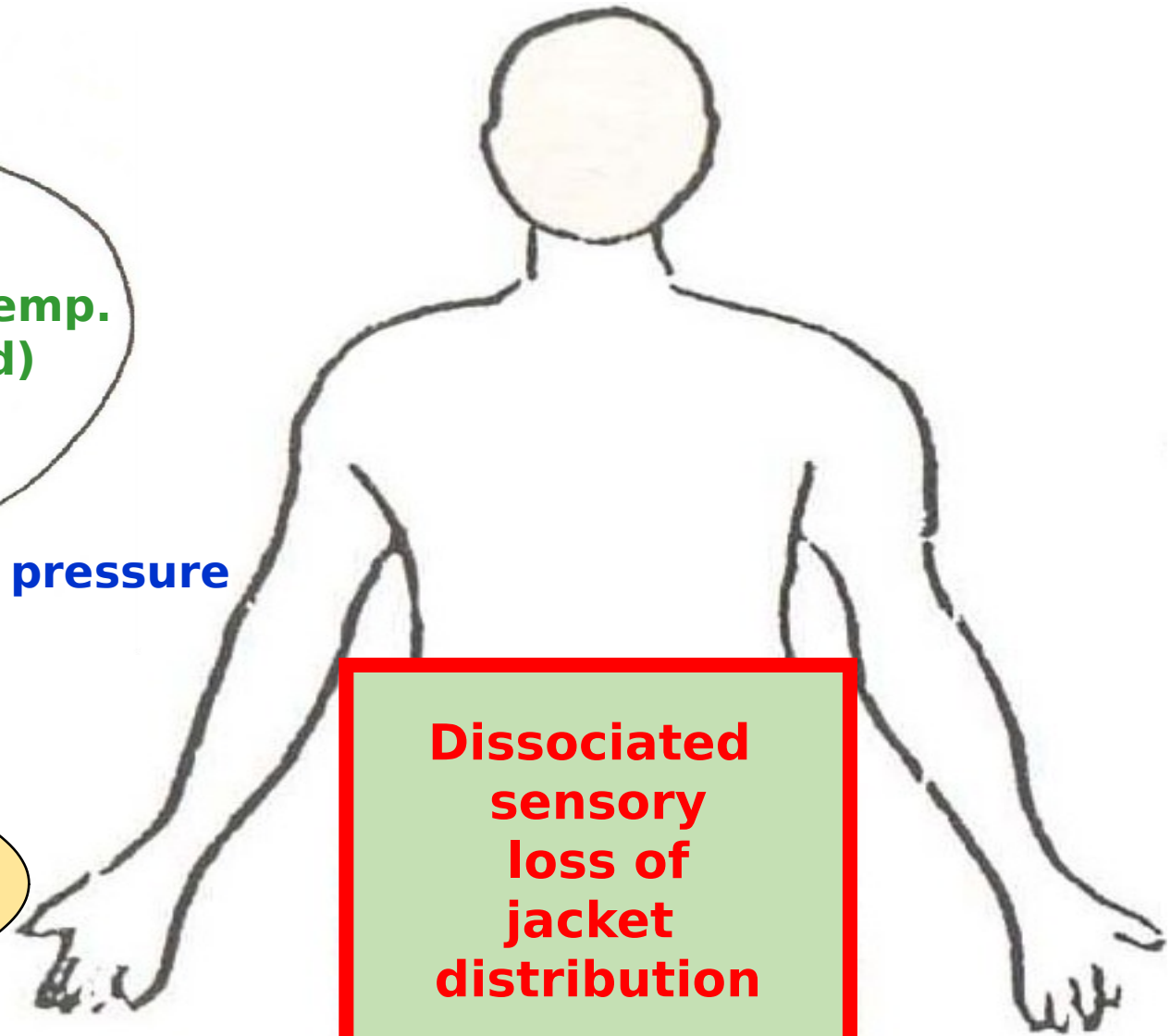
Overall Picture



Syringomyelia



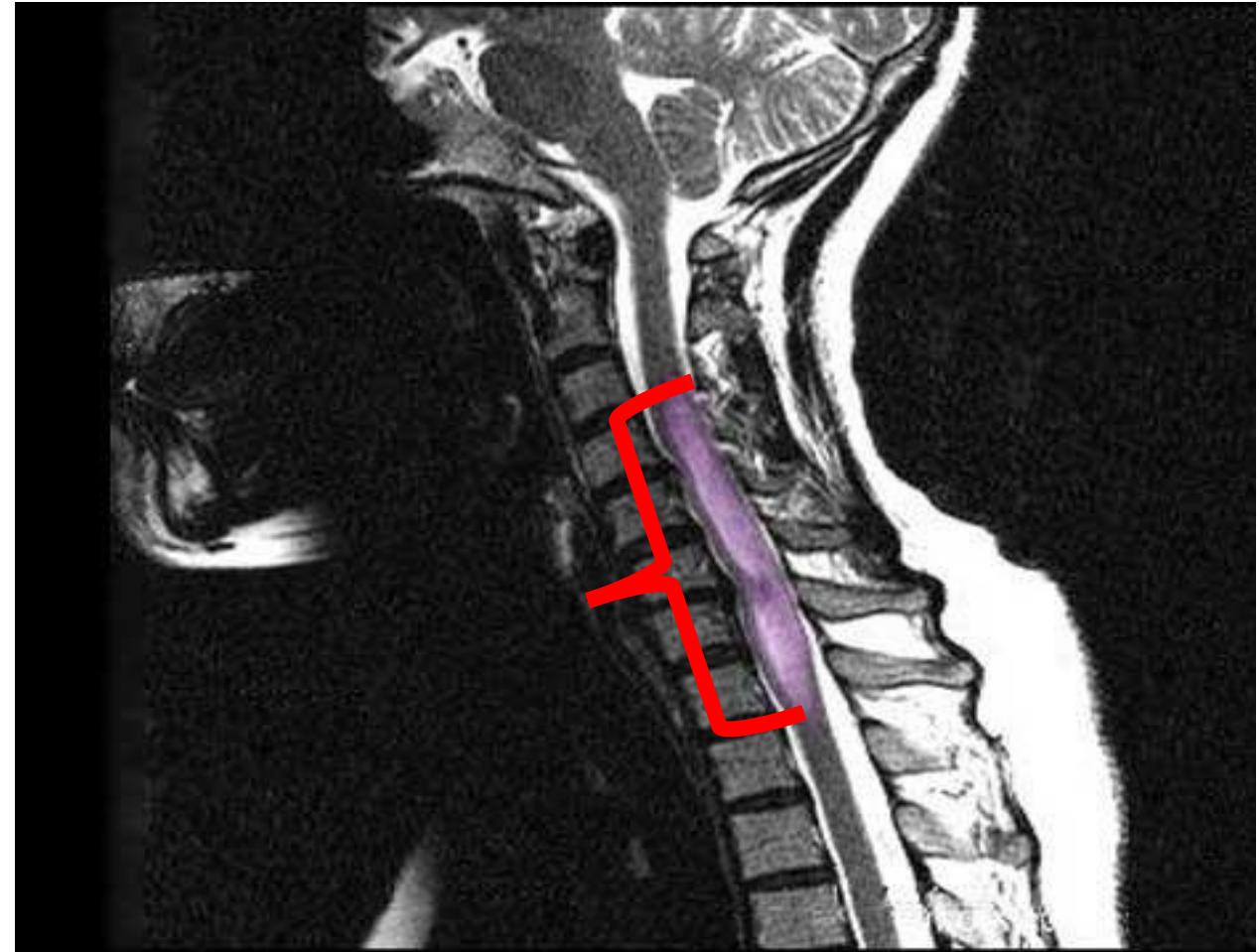
Syringomyelia is a disease of the **GREY** matter of the **lower C. & upper T.** spinal segments



**Dissociated
sensory
loss of
jacket
distribution**

Syringomyelia

- 1- It is a degenerative disease of the **grey matter** characterized by cavitation around the central canal of the spinal cord.
- 2- Predominates in **males** during the **2nd & 3rd** decades.
- 3- Usually affecting the **upper C. & lower T.** segments.
- 4- Leading to **“DISSOCIATED SENSORY LOSS OF JACKET DISTRIBUTION”**:
 - a. **Pain & temp. are lost** (since they cross in the ant. **GREY** commissure).
 - b. **Crude touch & pressure are spared** (since they join the med. lemniscus).



Lecture Quiz



The second order neuron of pathway of crude touch from the body is the:

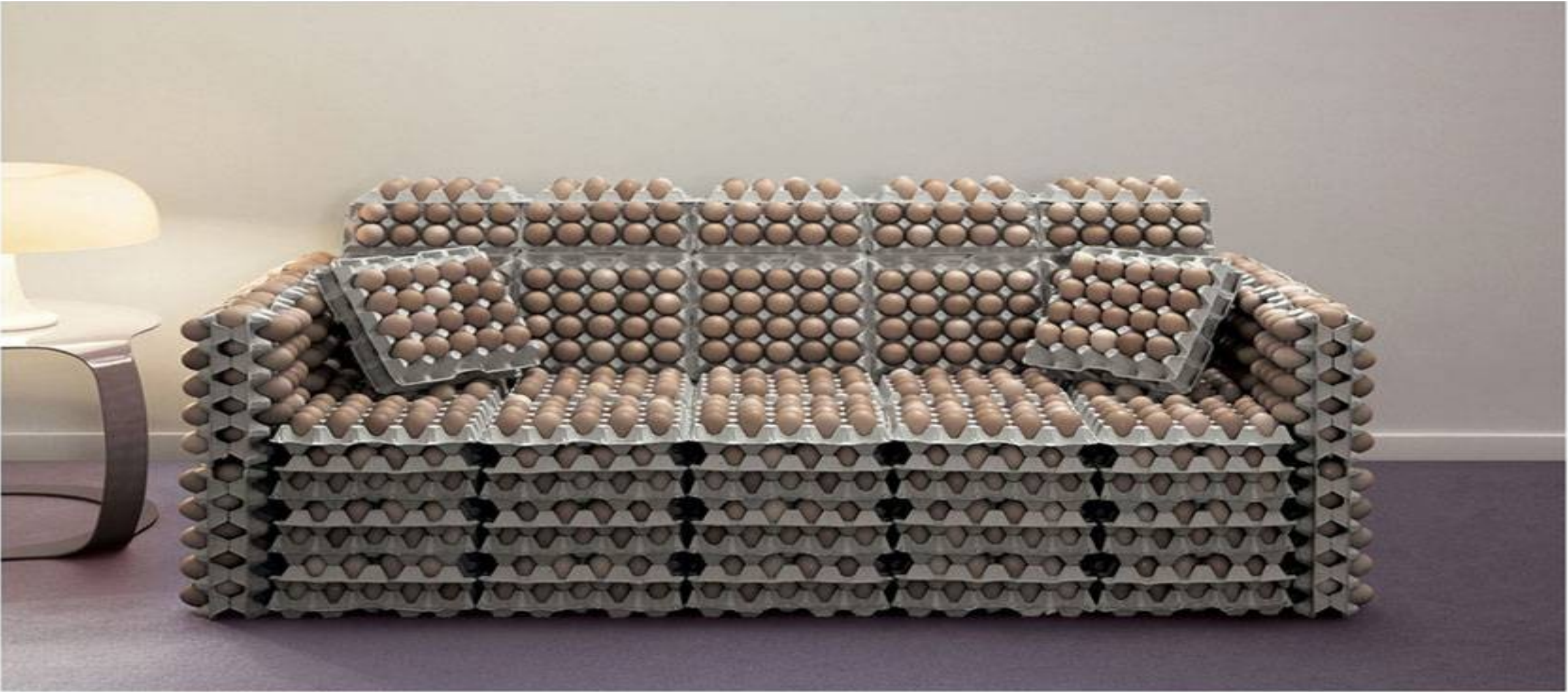
- a. Dorsal root ganglion.
- b. Main sensory nucleus.
- c. Substantia Gelatinosa of Rolandi.
- d. Clarke's nucleus.
- e. PLVNT.



The second order neuron of pathway of crude touch and pressure sensation from the body is the:

- a. Dorsal root ganglion.
- b. Main sensory nucleus.**
- c. Substantia Gelatinosa of Rolandi.
- d. Clarke's nucleus.
- e. PLVNT.

Relax, if you can



Dorsal Column Tracts

Fine touch & Proprioception Pathway = Dorsal column tracts

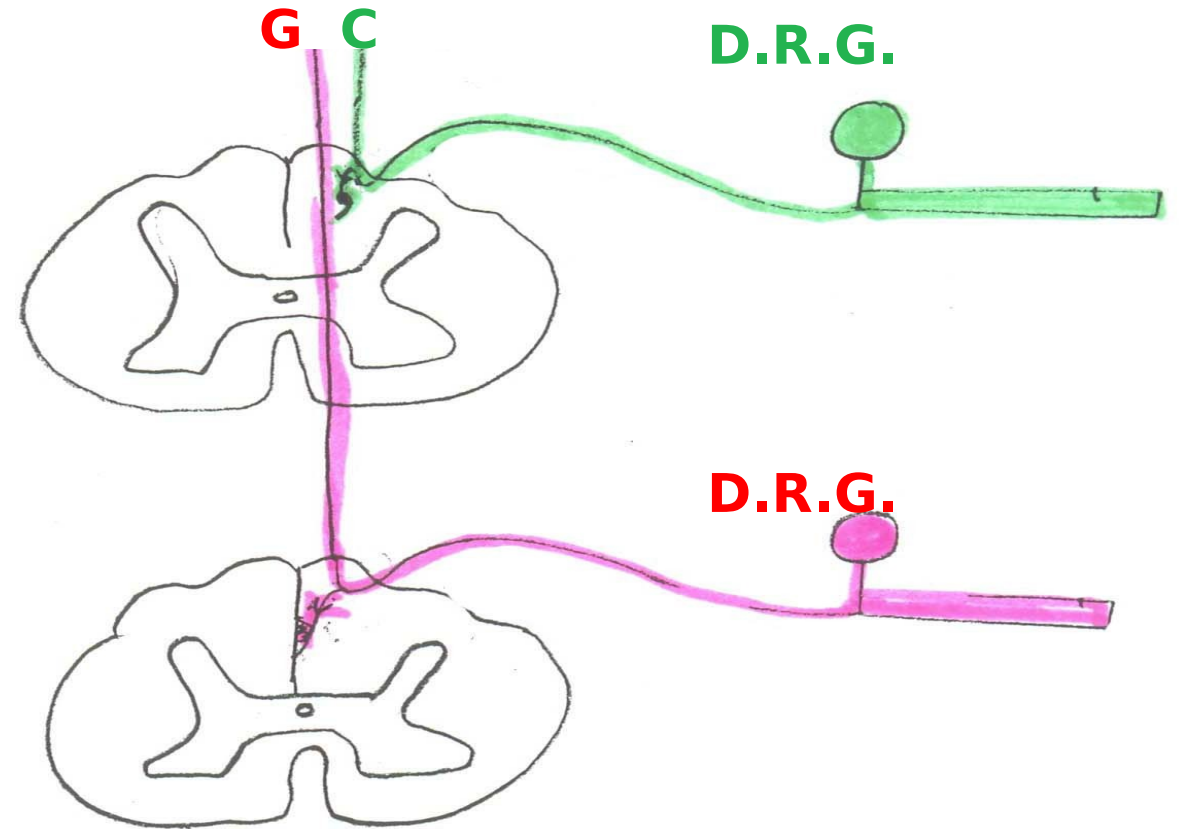
- **1ST ORDER NEURON:**

- Dorsal Root Ganglion (D.R.G.):**

- 1- Cells: are pseudo-unipolar
- 2- Peripheral processes: Carry fine touch & proprioception from the receptors.
- 3- Central processes: enter the dorsal column:

- a** Fibers from the lower ½ of the body & LL pass **med.** in the dorsal column forming the **Gracile tract.**

- b** Fibers from the upper ½ of the body & UL pass **lat.** in the dorsal column, forming the **Cuneate tract.**



Fine touch & Proprioception Pathway = Dorsal column tracts

• 2ND ORDER NEURON:

Gracile & **Cuneate** nuclei of the medulla oblongata

1- Cells: Cells of **Gracile** & **Cuneate** nuclei

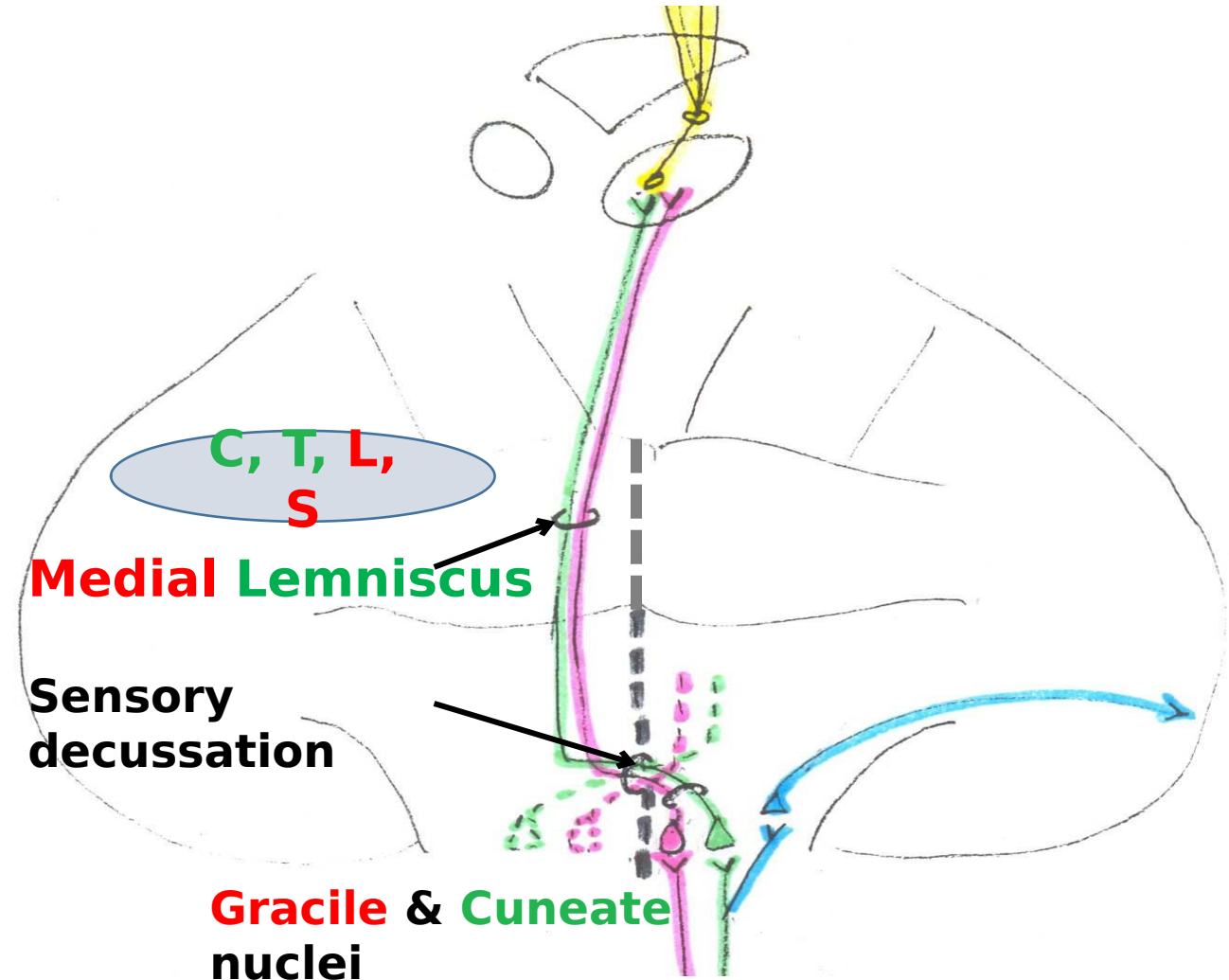
2- Axons:

a. Cross to the opposite side forming with the contralat. fibers the **Sensory Decussation**.

c. Ascend in the brain stem close to midline (together forming the **Medial Lemniscus**) which is joined by the ant. spinothalamic tract.

d. **Lamination:** **C.** fibers are lat. & **S.** fibers are med.

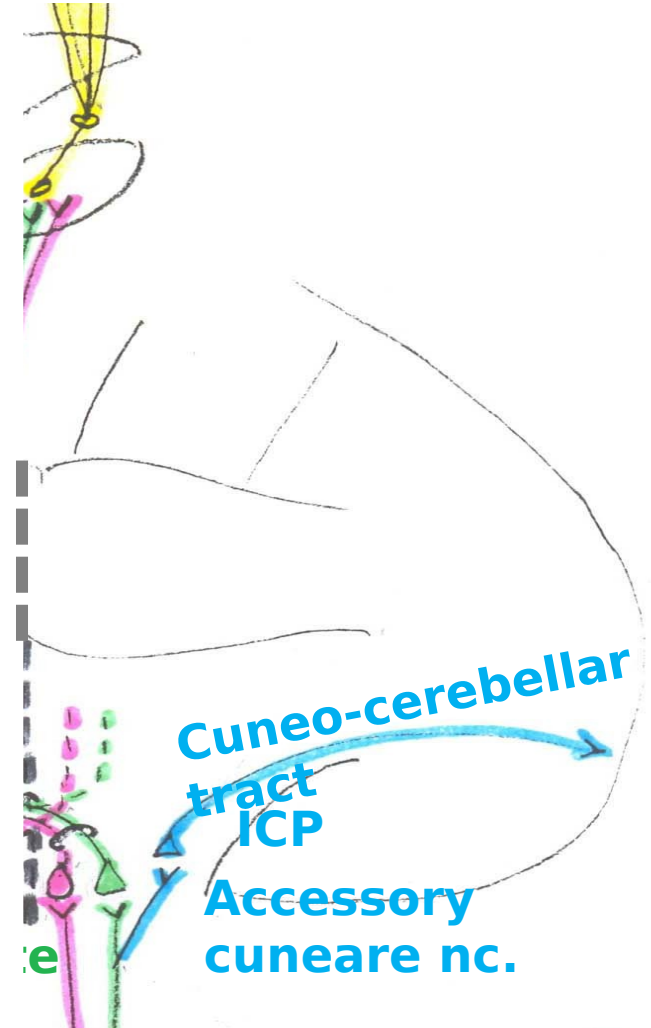
e. Terminate in: (P.L.V.N.T.) **P**ostero-**L**ateral **V**entral **N**ucleus of **T**halamus.



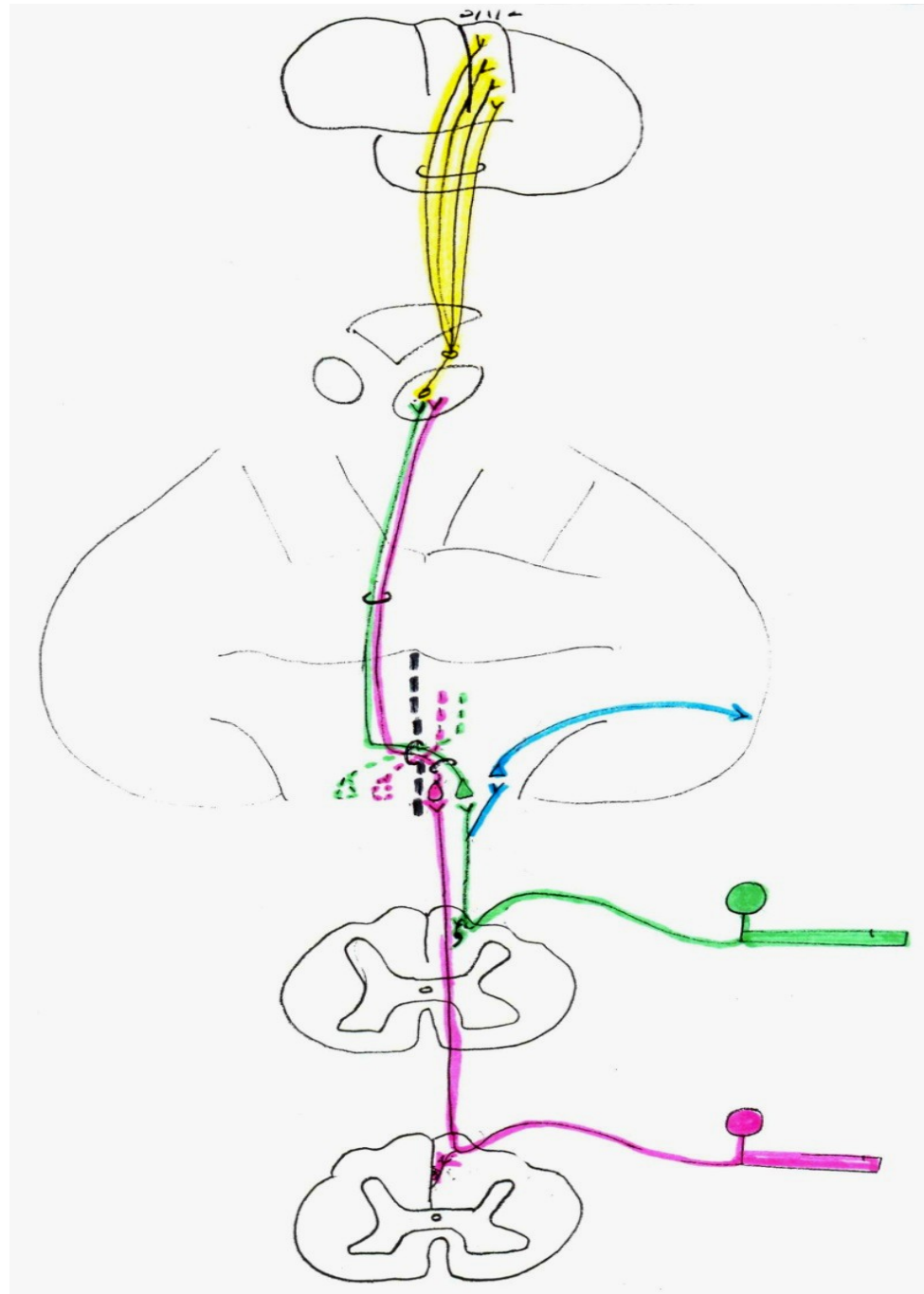
Fine touch & Proprioception Pathway = Dorsal column tract

- **N.B.:**

- Some **C.** fibers ascend in the cuneate tract, but leave it to terminate in the **accessory cuneate nucleus** in medulla.
- Its axons leave the medulla as the **cuneo-cerebellar tract** → via the inf. cerebellar peduncle (**I.C.P.**) → terminate in the **cerebellum**.
- These fibers carry unconscious proprioception from the UL.

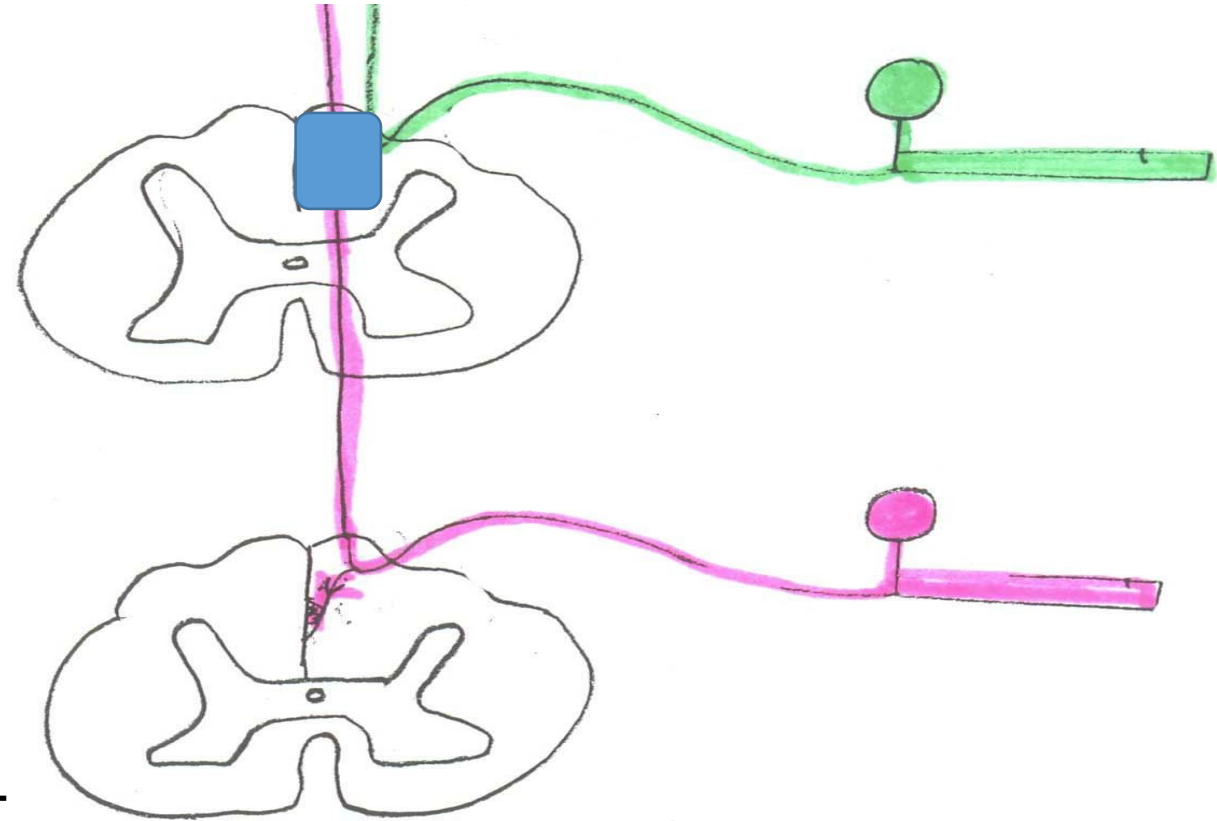


Overall Picture

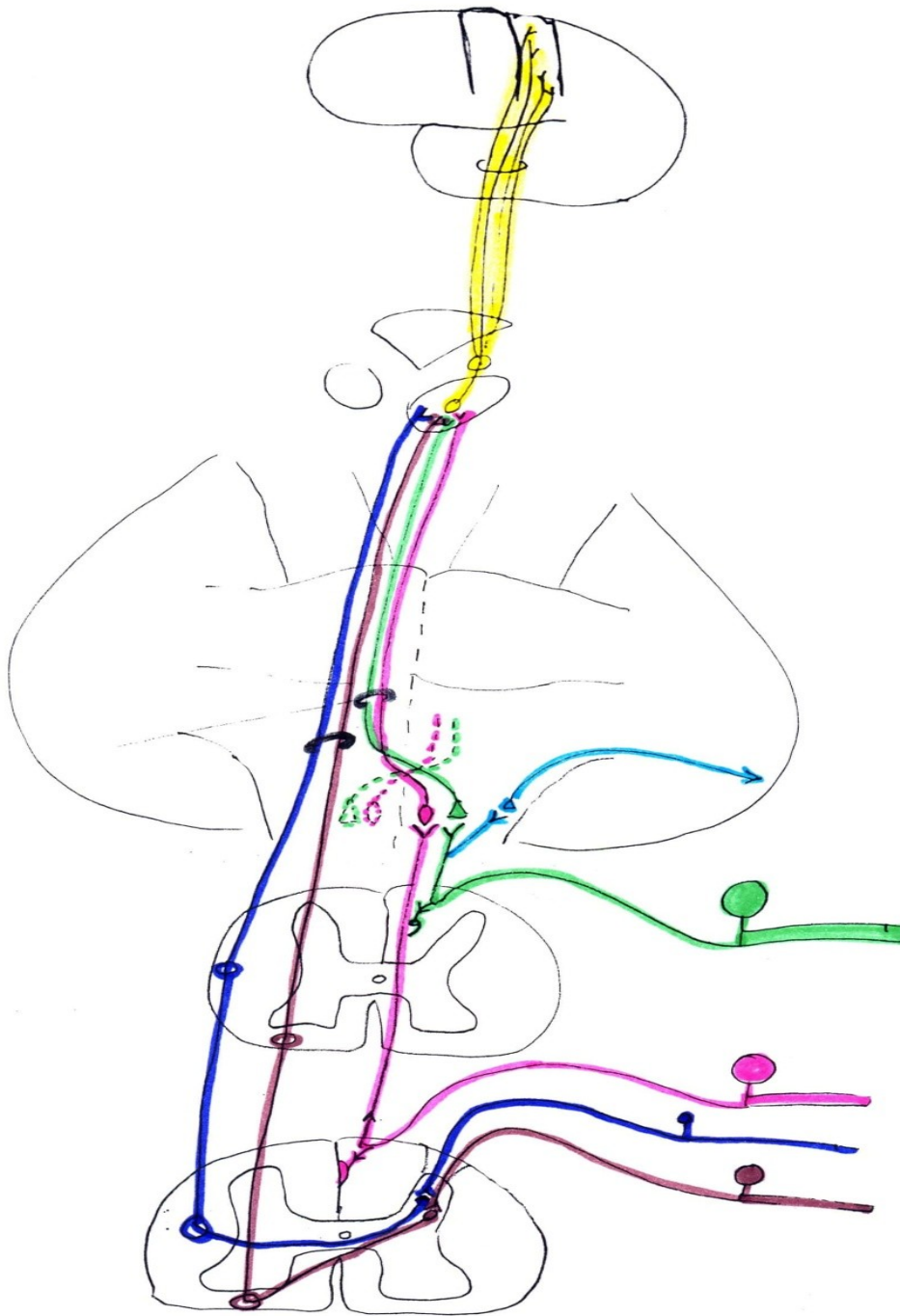


TABES DORSALIS

- 1- It occurs when syphilis affects the C.N.S. (dorsal column) of the spinal cord).
- 2- Predominates in **males** above **25- 45 years** & its onset is 5- 15 years after the primary infection.
- 3- Affection of the dorsal column leads to:
 - a. Loss of proprioception & light touch.
 - b. Sensory ataxia & **+ve Rombergism** (if the patient



4 Long Ascending Tracts





Conscious sense of sartorius muscle is carried by which of the following tracts?

- A. Ventral spino-thalamic.**
- B. Dorsal spino-thalamic.**
- C. Lissauer's.**
- D. Gracile.**
- E. Cuneate.**



Conscious sense of sartorius muscle is carried by which of the following tracts?

A. Ventral spino-cerebellar.

B. Dorsal spino-cerebellar.

C. Spino-olivary.

D. Gracile.

E. Cuneate.

Thank
you!

